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APOLLO MONTHLY PROGRESS REPORT (U)

NAS9-150

1 August 1963

Report Period

16 June to 15 July 1963

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SPACE and INFORMATION SYSTEMS DIVISION

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ILLUSTRATIONS

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PROGRAM MANAGEMENT

STATUS SUMMARY

Boilerplate 6 was air-shipped to WSMR via C-133 aircraft on 1 July 1963. Preparation of the command module, GSE, and the launch pad was begun at WSMR for the pad abort test of boilerplate 6. The remaining models of GSE to support boilerplate 6 are to be completed during the next report period.

Two land impact drop tests of boilerplate 1 were conducted at the Downey impact test facility during the report period.

A recommendation was submitted to NASA to delete the command module side strakes and add modified strakes on the apex of the command module, or a strake which could be jettisoned with the launch escape tower. Alternate strake configurations are illustrated in the development section of this report (page 6).

The launch escape tower for boilerplate 12 was delivered for final installation during the report period. Of the total 83 GSE units required for this boilerplate, 41 have been completed.

MANUFACTURING

Olin Metals, supplier for electrical power subsystem and environment control subsystem radiator panels, delivered 16 test panels to S&ID during the report period. Manufacturing will use six of these panels to ascertain the feasibility of heat treating, forming, and chem-milling the panels. Three test panels, employing two different fabrication methods, were completed by Manufacturing and delivered to Engineering for testing. In addition, an alternate in-house design has been completed by Engineering.

Four pitch control motors were fired successfully during the report period. Only three development test firings remain to be completed for this program; these firings are scheduled to take place during the next report period.

The first simulated altitude firing of a full-scale service propulsion engine was test fired for three seconds at AEDC on 26 June 1963. The nozzle extension was damaged during shutdown. Twelve firings were made on the doublet injector and instability was noted during four firings. Following minor modification of the injector, five satisfactory firings were accomplished.

PERT OPERATIONS

Computer capabilities have been expanded to include milestone coding and notation dates on integrated data processing (IDP) cards. This will provide NASA with status information from the PERT networks for updating OMSF charts.

Computer programming has also been accomplished to provide the application of end item or launch dates to selected vehicles. This provides total program visibility, based on many vehicles rather than on a single end item.

CONTRACT STATUS

The negotiation bases for 13 of the major subcontractors have been presented to NASA for review. Negotiations have been completed with ten contractors — contracts have been written for six, and four contracts are in preparation. Negotiations are currently in process with three additional contractors. The target dates for the completion of these negotiations are as follows:

Subcontractors	Target Date
Marquardt	July 1963
Northrop-Ventura	July 1963
AiResearch	August 1963

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NEW PROCUREMENTS

During the report period, Avien, Incorporated, was selected as the contractor for the 2 kmc high-gain antenna. An additional system, proton direction detection, was added. Orders are in process for the following items and it is planned that orders will be placed during the months indicated:

Items	Target Date
In-flight test system	July 1963
Pyrotechnic batteries	August 1963
Up-data digital link	July 1963
Proton direction detection	Undetermined

Interface and control procedures between S&ID and Convair for the spacecraft command and service modules and the Little Joe II launch vehicle have been established.

DEVELOPMENT

TECHNOLOGY

Flight Performance and Control

The boilerplate 6 range safety report was delivered to NASA-MSC. The report included trajectories (without failures) that would result with assumed windspeeds of 20 knots. Trajectories were plotted for the complete space vehicle at launch, for the command module alone, and for the escape tower alone. An over-all potential impact area extending from the launch pad 10,000 feet north and south, and 4,000 feet east and west, was predicted if failure occurs. Failures such as inoperative pitch motor, nozzle blowout, premature thrust termination, and run-away tower were considered.

Studies were made to determine the effect of various possible types of stabilization control and reaction control subsystems failures during atmospheric entry. Simulation studies are scheduled during this report period to determine the ability of the astronauts to identify these types of failures and to make use of alternate existing subsystems.

A report was submitted to NASA recommending deletion of the present side strakes, the addition of a modified strake mounted on the apex of the command module (jettisonable with the launch escape subsystem (LES) tower on a normal mission) (see Figure 1), and the incorporation of a second drogue parachute to provide the necessary redundancy. Wind tunnel tests are being conducted to determine the aerodynamic characteristics of the modified strakes. The existence of an apex forward trim point on the command module necessitates these changes. If the command module were to trim apex forward during a high altitude LES abort, the crew would sustain excessive g forces. In this same trim position, during a low altitude abort, there is a potential problem in regard to the apex cover not clearing the command module. High terminal dynamic pressure makes it imperative that the drogue parachute operate correctly.

A comparative analysis was made of three possible techniques for performing the Saturn V heat shield test. These techniques are as follows:

1. Direct boost to entry, with suborbital coast between stages.
2. Boost to a parking orbit of 100 nautical miles with the S-IC and S-II stages; with the S-IVB, inject into an elliptic orbit having an

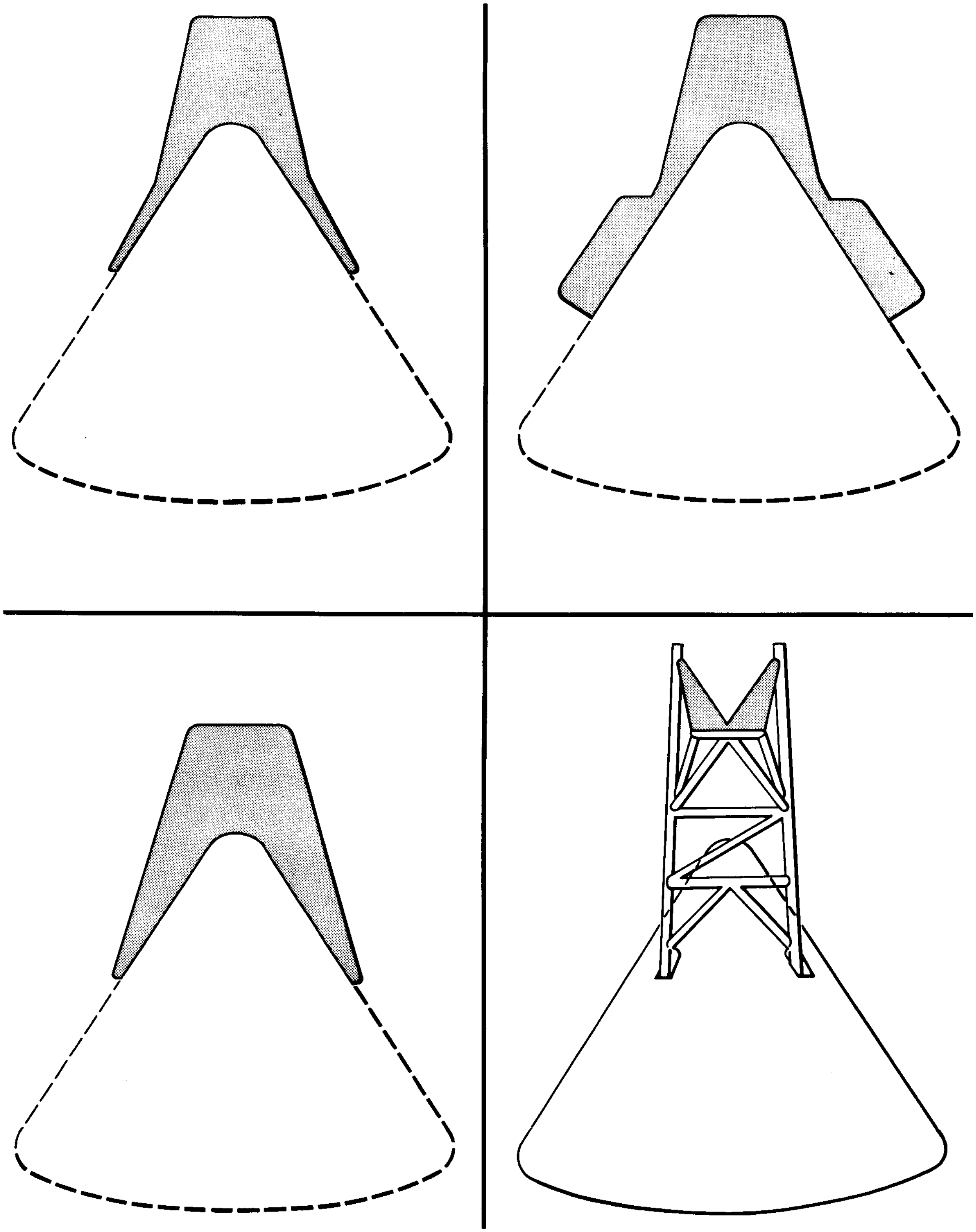

Figure 1. Strake Configurations Being Studied

apogee near 1200 nautical miles. At apogee, restart the S-IVB to burn down to acceptable entry conditions.

3. Boost into an elliptical orbit having an apogee at about 100 nautical miles using the S-IC and S-II stages. Circularize the orbit at apogee using the S-IVB to give a parking orbit at about 1000 nautical miles. Permit the S-IVB stage to burn down to acceptable entry conditions.

Booster performance will be adequate to include a command module, service module, and lunar excursion module adapter for any of these three techniques.

Thermal and Fluid Dynamics

During the report period, the use of radioisotope heaters was proposed to NASA for the propellant lines of the service and command module reaction control subsystem (RCS) and the service propulsion subsystem (SPS). Heaters are required to prevent propellant freezing and to avoid cracking of the ablative nozzle material. The estimated power requirements are 2340 watt-hours per SPS tank for the transearth mission phase and 3560 and 1660 watt-hours, respectively, per RCS cluster for translunar and transearth flights. (During the translunar mission, the SPS tanks are relatively full. This condition slows the rate of heat dissipation and eliminates the need to heat the tanks. Heaters in the line lessen cracking of the ablative material due to thermal conductivity from the line to the nozzle material.)

The predicted effect on the optical properties of the command module windows caused by LES and tower jettison motor exhausts has been reported to NASA. Pitting of the windows and the collection of soot in these pits are probable.

Combustion stability analysis, based on steady-state operation of the SPS, has shown that the SPS propellant feed system proves to be an inherently stable system. The system resonant frequency is estimated to vary from 128 to 38 cycles per second for the expected combustion delay time of 2 to 7 milliseconds. Excitations at other frequencies are lessened by the dampening effects of the feed system.

A revised estimate of entry heating was completed. New distributions of integrated heating loads show 89.09 percent of the total load on the aft heat shield, 8.59 percent on the windward cone, and 2.32 percent on the leeward cone. The new total heating load on the command module during the maximum heating load entry case is 77 percent of that originally computed.

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Large amplitude-free oscillation tests were completed of the command module and launch escape vehicle model to determine dynamic stability derivatives. At subsonic Mach numbers, the launch escape vehicle showed unstable damping near 0-degrees angle of attack. The command module was slightly stable in the heat shield forward attitude for the present center-of-gravity position. The command module in the apex forward position with strakes seemed to give unstable damping through the whole Mach number range. Without strakes, marginal dynamic stability was noted at Mach numbers 0.7 and 0.9.

An analysis was completed of the steady-state concentration of carbon dioxide in the cabin for a metabolic load of 11,200 Btu per man-day and a processing rate of 14 pounds per hour. At zero suit bypass, the concentration of carbon dioxide at the suit outlet is 3.9 millimeters of mercury.

The heat loads on the suit circuit heat exchanger were calculated for emergency operation with one crewman in the suit (8 hours on duty) and two crewmen on the moon, and with three crewmen in suits. These heat loads were determined to be, respectively, 1185 Btu per hour and 2070 Btu per hour.

The passive cooling study of the lower equipment bay was continued and duty cycles were determined for all equipment requiring coldplates to control operational temperatures. These duty cycles are considered as a minimum cooling requirement in the event of complete loss of the spacecraft water-glycol system while the lunar excursion module is on the lunar surface and its cooling system is not available as a substitute unit for the spacecraft.

A detailed presentation was made to NASA-MSC during the report period concerning the feasibility and the requirements necessary for using operational nuclear radiation instrumentation. It was agreed that S&ID will continue analytical studies for solar radio frequency warning and proton directionality systems. S&ID will proceed with procurement of an external nuclear radiation detection system that will be displayed in the command module and telemetered to the ground.

Life Systems

A command module habitability study with test subjects remaining in the capsule nearly 4 days was completed during the report period. The following observations were made regarding hardware, operations, and medical problems:

Hardware

1. Cabin lighting was good and did not interfere with sleep.

2. The headgear and attached earphones require modification for greater comfort.

3. The urine storage area requires ventilation.

4. Constant-wear garments are too bulky.

5. Velcro shoestraps are too noisy.

6. The lapboard requires a clip, and the sleeve of the constant-wear garment requires a pencil pocket.

7. The food reconstitution probe could not be cleaned.

8. The duty couch should support the sacrolumbar region of the spine.

9. The shaver motor operated too slowly.

10. Switch identification labels were not specifically located in relation to the applicable switch.

Operations

1. Simulation of all flight phases was good, but additional premission operator training is required.

2. Equipment checkout must be conducted progressively during the test preparation phase.

3. Sterilized equipment must be placed in the cabin one day before crew entry.

4. The diet was nutritious but lacked variety.

5. Operation of communications equipment was unsatisfactory.

6. Smoother electrocardiograph sensors are required for the comfort of the test subjects.

7. Four hours of continuous tracking is too strenuous.

8. The crew work-rest cycle of 16 hours on duty and 8 hours of sleep is acceptable but requires crew adaptation.

Medical Problems

1. The test subjects showed a loss of cardiovascular efficiency.

Simulation and Trainers

A mock-up review of the Apollo mission simulator was held during the report period. Mock-ups evaluated were the command module, instructor-operator console, telemetry console, and visual systems. Eighty-nine change requests were made, including the following significant items:

1. A redesign of the telemetry console to reduce it in size.

2. A redesign of the malfunction control and display unit to simplify crew instruction.

3. The inclusion of visual simulation of a complete rendevous and docking maneuver with the lunar excursion module.

4. The introduction of a common design for the Apollo mission simulators and the Apollo part-task trainer, particularly in the instructor's console (see Figure 2).

Disposition of all change requests is scheduled during the next report period.

A review of the Apollo part-task trainer instructor console mock-up was also held during the report period. NASA made 52 requests for changes during this review. Significant change requests included the exchange of the locations of the navigation and guidance and setup/checkout stations, a malfunction control and display mechanization, and a new call director station configuration.

Engineering effort has resulted in the completion of the computer mechanization and checkout of the initial entry study for evaluator 1. Simulation runs of the various stabilization and control subsystem (SCS) modes during entry are now being made.

Accuracy problems were detected in the all-analog automatic rendezvous simulation. A plan is being developed to use digital and analog

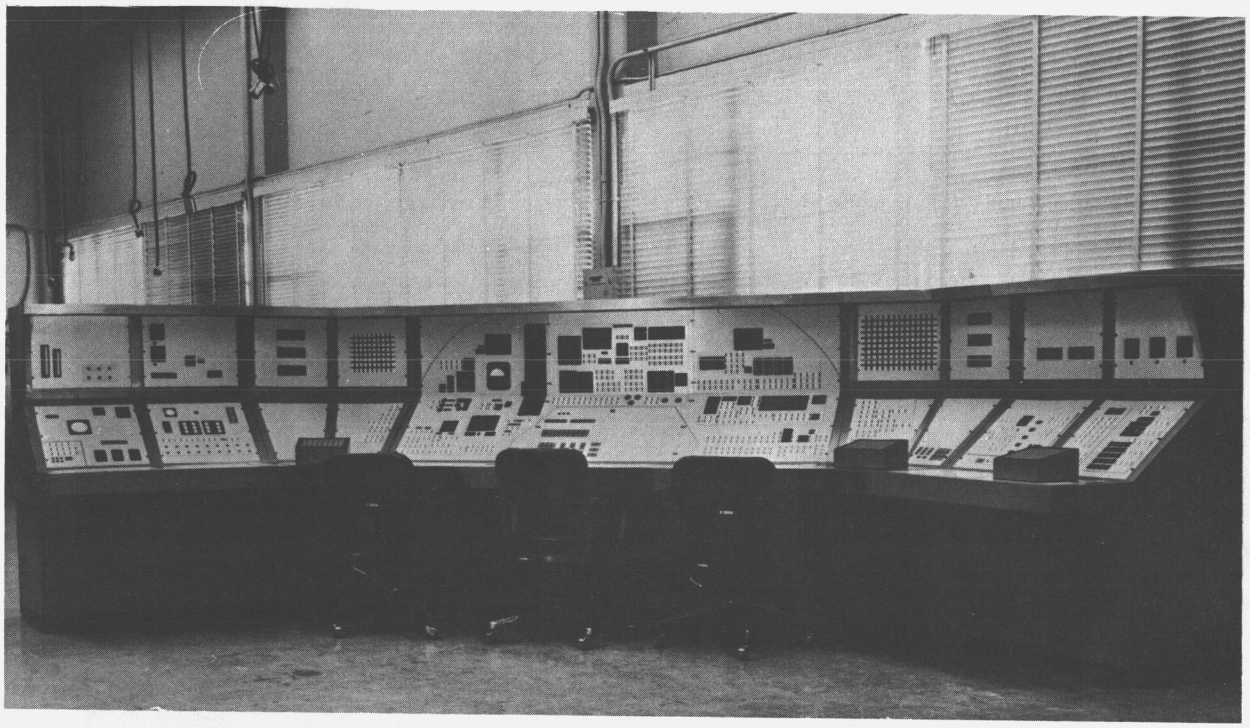

Figure 2. Apollo Part-Task Trainer Instructor Console

computers in hybrid combination where the greater accuracy of the digital computer is used for the solution of orbital, range, and axes system problems. This hybrid combination of computers should be operational during the next report period.

Structural Dynamics

The latest data on flotation attitudes, water-line positions, and pitch characteristics are being incorporated in a study on crew survival. The present center-of-gravity location will result in two stable flotation attitudes.

S&ID published a flotation analysis report to explain the digital computer method for evaluating the stable attitudes of the command module in a calm sea. Sample calculations were included to demonstrate the strength of a stable position in terms of the energy required to change the command module to a different, second, stable attitude.

A new 1/10 scale model of the command module was fabricated and is ready for testing in the S&ID laboratory tank. This model has provisions for varying the weight, center of gravity, and moment of inertia, and can be modified to provide different amounts of flooding between the inner and outer hulls. During the next report period, the following three phases of testing are scheduled: landing impact and stability in calm sea, landing impact and stability in various other simulated sea states, and static and dynamic flotation stability.

As a result of recent full-scale boilerplate drop tests, the structural representation portion of the digital computer program for analyzing land impact is being modified.

Vibration frequencies and patterns were calculated for the docking mechanism between the lunar excursion module and the command and service module. The study showed that the upper limit for the first bending mode is 80 radians per second. Practical values of flexibility coefficients, however, indicate frequencies between 17 and 30 radians per second.

The digital computer program is being modified to include recent changes in the probe and drogue mechanism. This program analyzes the impact phase from initial contact to latching and is being modified to include post-latching behavior.

A large curved panel, representative of the spacecraft service module structure, is being fabricated for vibration and acoustic testing. Plans have been made to install dummy components to simulate internal mass distribution so that the responses of internal equipment to external excitations can be studied. Tests will be made to determine panel modes, vibration and acoustic transmissibility measurements, and evaluation of damping characteristics.

An analysis of the data from tests of the cabin blower indicates that a secondary panel vibration induces additional noise in the command module. A design modification is under consideration.

SPACECRAFT AND TEST VEHICLES

Structures

One parachute test of boilerplate 3 was conducted during the last report period in support of boilerplate 6. It was launched from the C-133A aircraft at an altitude of 13,000 feet. Separation of the test vehicle from the C-133A was normal. The stabilization parachute was released at 10,000 feet, at a dynamic pressure of about 40 pounds per square foot, and deployed satisfactorily, rotating the boilerplate to the apex forward position. Three seconds later the apex cover was jettisoned, followed by drogue deployment one second later. After four seconds, the drogue was released and the pilot parachutes for the main parachutes were deployed. The main parachutes were then deployed with initial blanketing of two parachutes. The aft heat shield was extended at 5000 feet and subsequent descent and impact were normal.

Drop tests 46 and 47 of boilerplate 1 of the land impact and stability program were performed under the same drop test conditions used for boilerplate 3. The vertical and horizontal velocities were both 27.8 feet per second. The command module pitch angle was -35 degrees, the roll angle was 180 degrees, and the yaw angle was 0 degrees. The impact was at 5 degrees onto a down-slope of hard-packed soil. On drop test 46, the boilerplate rolled over and crushed the escape cylinder; the aft heat shield received major damage. New crew couch friction struts were employed in the X-X and Z-Z axes and proved satisfactory. On drop test 47, a rigid airlock was installed, yielding a more accurate spacecraft simutation. Rigidity was achieved by increasing the wall thickness of the escape cylinder and supporting it with four gussets. The test was a successful simutation of the command module tumbling mode as the escape cylinder did not collapse.

Boilerplate 28 has been added by NASA for the purpose of conducting additional earth landing tests. This new vehicle will be used to determine landing loads imposed on the structure and crew, and the stability and dynamics imposed upon the vehicle by the tumbling concept. (Boilerplates 1 and 2 are not adequate to achieve several of the desired objectives.)

Tests on the alternate heat shield program were concluded because the alternate ablative materials could not meet the required environmental conditions.

Preliminary results of the tests on PH14-8Mo steel, used for the heat shield substructure, indicate that this material can be chemically milled within specification limits for both roughness and thickness.

During the report period, tests of the separation system for the launch escape tower were completed. Satisfactory results were obtained for the flight requirements of boilerplate 6. The initiator preflight qualification tests are now in progress.

The titanium development tank for use in the SPS has been successfully burst-tested. Actual burst pressure was 460 pounds per square inch compared to a minimum acceptable burst pressure of 381 pounds per square inch. The tank is one of the largest ever to be fabricated from titanium. The test substantiates the thin-wall design concept and fabrication techniques to be used in Apollo pressure vessels.

The land impact test of boilerplate 1 is shown in Figure 3; the water impact test of boilerplate 2 is shown in Figure 4. These tests were conducted during the report period.

Guidance and Control

The configuration of the spacecraft rotational control and the flight director attitude indicator (FDAI) ball markings were determined at a meeting with the astronauts. The rotational control will have a pistol grip and be perpendicular to the arm of the astronaut's couch. The standard aircraft-type FDAI ball markings (poles in vertical position) have been changed to agree with the inertial measurement unit (IMU) gimbal angles. This shifts the poles to the 90-degree and 270-degree yaw points on the 0-degree pitch line. The singularity points, therefore, coincide with the IMU gimbal lock areas (shown as two red zones 180 degrees apart on the FDAI ball).

An electronic systems simulation plan conforming to current guidance and control hardware was presented to NASA. The plan outlines five hardware evaluation programs: design verification, failure evaluation, flight verification, postflight verification, and special test programs.

During the report period, the design base of the SCS and bench maintenance equipment (BME) was established in a meeting with Minneapolis-Honeywell.

The SCS functional model "A" BME test table is being tested. Assembly of this test table will be completed upon receipt of four chassis assemblies and all connectors for the SCS components, which are promised for delivery during the next report period.

Development testing of the BME functional model "A" test console continues and is two weeks ahead of schedule.

Telecommunications

Changes are being made in the on-board data storage equipment to provide a "fast dump" capability. This will reduce the loss of real time data during transmission of recorded data. The storage equipment now will record at a speed of 3.75 inches per second and playback at a speed of 120 inches per second. (This is in addition to a second recording and playback speed of 15 inches per second.) Low-frequency analog data and low-rate PCM (1.6 kilobits per second) telemetry data may be recorded continuously for two hours and transmitted in 3.75 minutes; two hours of recorded voice may be transmitted in 30 minutes. The total operating power required for the S-band equipment and the workload of the astronaut

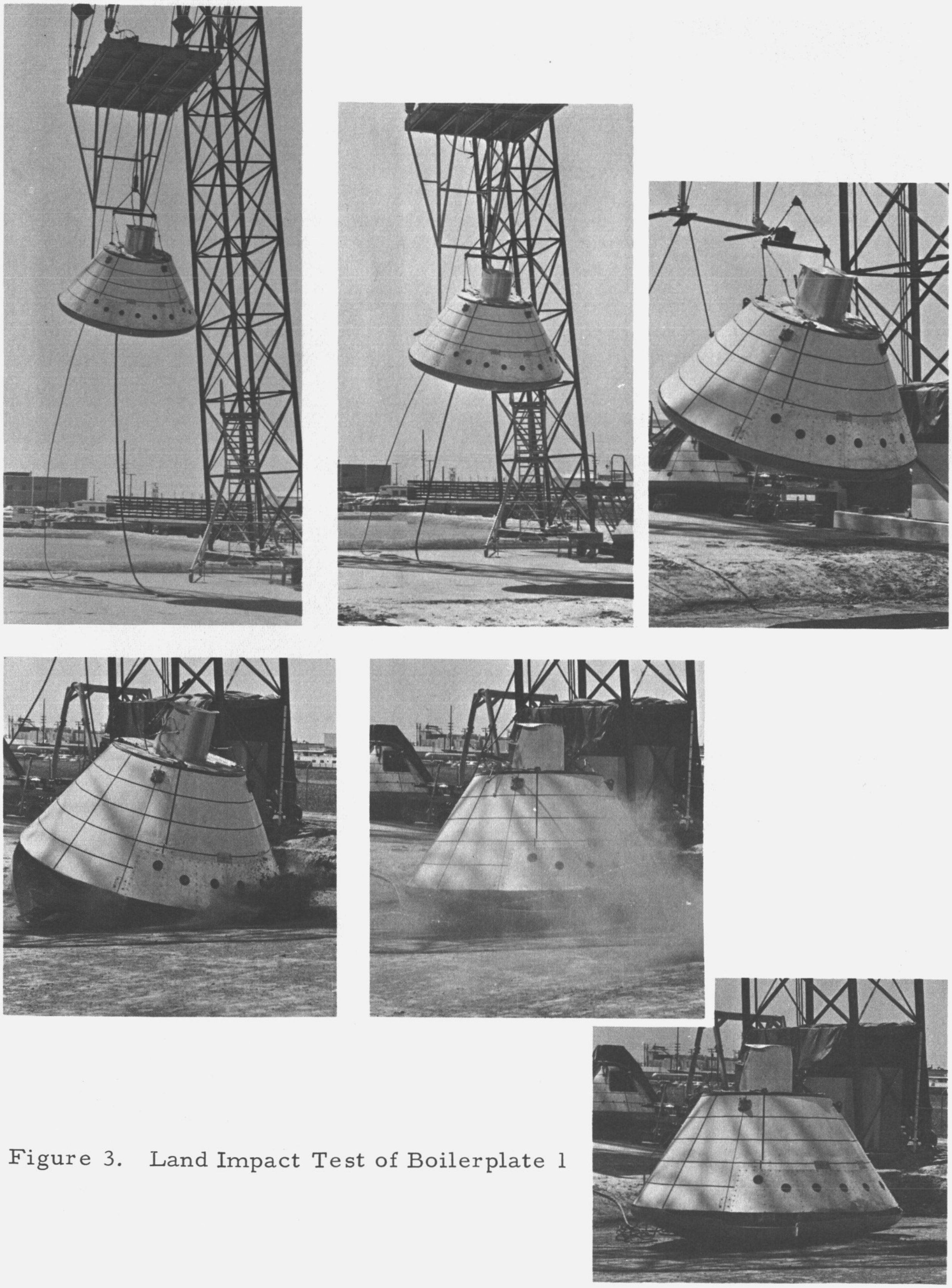

Figure 3. Land Impact Test of Boilerplate 1

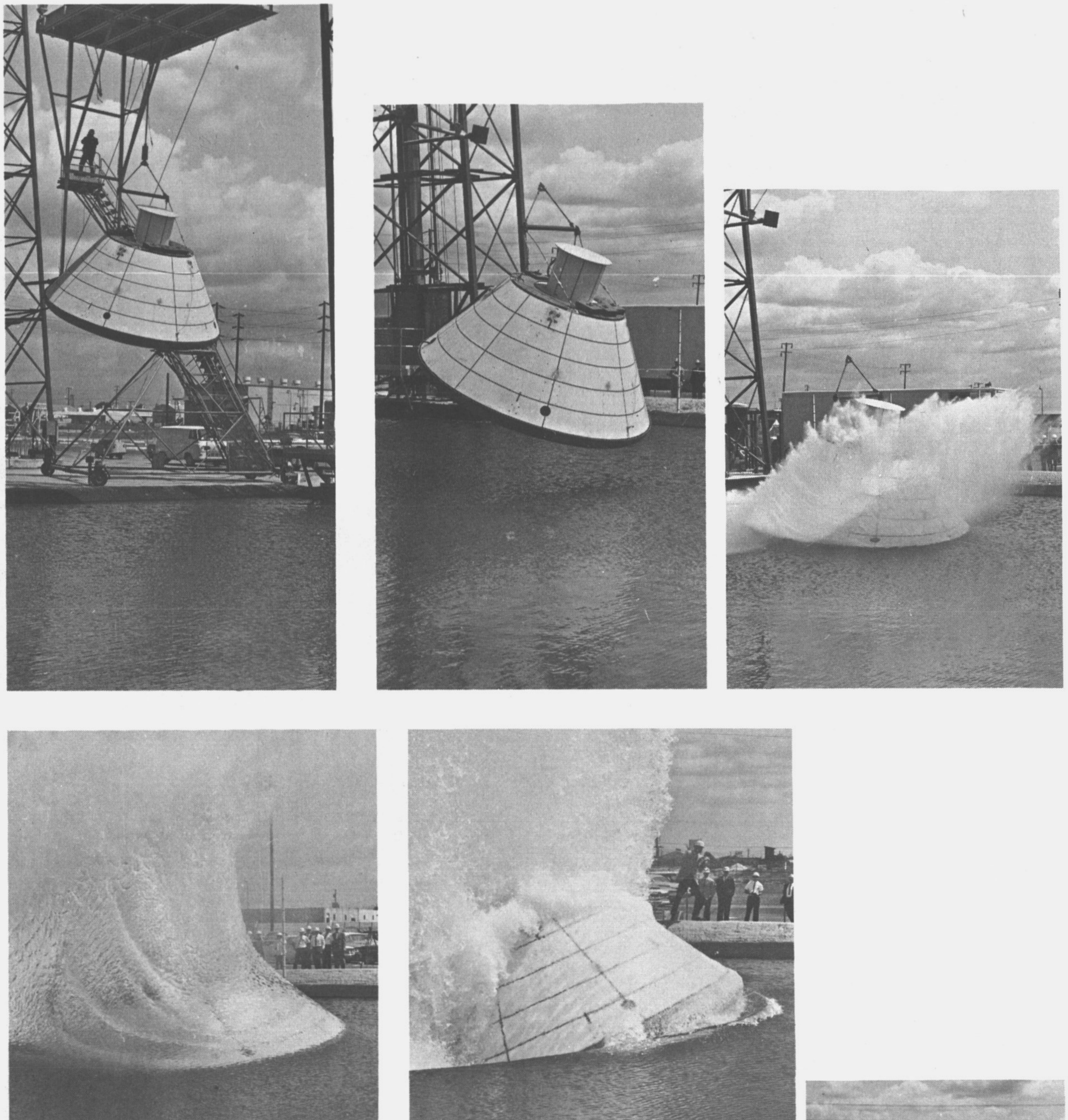

Figure 4. Water Impact Test of Boilerplate 2

remaining in the command module during lunar exploration will be reduced. A rapid analysis of a malfunction that may occur while the command module is behind the moon will be facilitated, and the problem of transmission of recorded data to GOSS during earth orbit will be eased when the time over the station is critical.

Redesign of the R&D spacecraft is planned to incorporate the isolator mounting of the NASA-furnished tape recorder. The mounting will be rotated 90 degrees to provide better support.

The HF transceiver frequency assignment has been changed from 10.005 megacycles lower sideband to 10.006 megacycles to avoid interference with station WWV (National Bureau of Standards time reference station).

NASA has authorized the incorporation of a digital up-data link subsystem. This change will provide a capability to send digital data from GOSS directly to the spacecraft for use in the navigation and guidance computer. The change will be effective on boilerplate 14 and on spacecrafts 006, 008, 009, and 011.

Instrumentation

All instrumentation spares for boilerplate 6 have been delivered to WSMR. Flight instrumentation breadboard tests are complete and the equipment is ready for installation in boilerplates 12 and 13 except for those items not received from NASA. Instrumentation items not received include 12 pressure transducers, 5 vibration subsystems, 1 temperature subsystem, 2 amplifier racks, 7 strain bridges, and 8 strain gages.

Sixty-five percent of the NASA-furnished flight instrumentation for boilerplate 23 has been received and calibrated. The breadboard is being rewired to incorporate the Q-ball.

Environmental Control Subsystem (ECS)

Extensive relocation of command module ECS equipment is required to adapt to the fixed-couch design, to improve the center-of-gravity location, and to improve astronaut operations. Associated changes will be required in the waste management subsystem which will relocate all controls, equipment, and associated lines; additional changes will be required in the compartment ventilation system, the fecal canister, and the urine nozzle plumbing. The waste management control panel will also require redesign and relocation.

The command module ECS oxygen supply subsystem is being redesigned to eliminate the entry oxygen supply assembly by adding a surge

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tank in the cryogenic oxygen storage subsystem. This will meet the necessary requirements for the entry oxygen supply and provide an available early-mission emergency flow without placing the cryogenic storage subsystem in a two-phase condition. This change will be effective on boilerplate 14; on spacecrafts 006, 008, 009, and 011; and on simulators 1A and 1B.

Other ECS changes consist of the relocation of the potable water tank, redesign of three coldplates, the addition of two coldplates, relocation of the associated plumbing, and the relocation of the pressure suit distribution ducting to comply with the added suit midcourse stowage provisions. A redesign of the ECS breadboard is required to conform to these changes.

A design layout is being prepared to show the method of purging the unpressurized aft and forward compartments in the command module with GSE-supplied gaseous nitrogen (GN_2). This purge is required to eliminate any fuel or liquid oxygen fumes that may leak into these compartments during propellent loading operations prior to flight. The GN_2 purge line routing will begin at the GSE disconnect tie-in, be routed through the service module-to-command module umbilical, and then to the aft and forward compartments. The purging equipment consists of a squib valve, a quick disconnect, and applicable plumbing.

Electrical Power Subsystem (EPS)

A total of five lots of pyrotechnic system initiators have been received and accepted during the report period. Difficulties were experienced in peak and back pressures. Redesign of the initiators will be required on subsequent lots.

Sequencer tests to determine the airworthiness of boilerplate 6 are in process. They will be completed during the next report period.

Up-dated procurement specifications for the fuel cell powerplant and the corresponding specification control drawings were released to Pratt & Whitney.

A back-up radiator design, incorporating a seam weld method of manufacturing, has been released. This type of radiator will be easier to manufacture and will be used as a back-up in case the roll bond prototype radiator is not available as scheduled.

Electronic Interfaces

The main and side display consoles are being redesigned to meet the requirements imposed by the adoption of the fixed-couch design. The design

[redacted]

of the support structures and the general arrangement of the consoles have been defined. Preliminary arrangements of the displays and controls on the individual panels are complete.

S&ID will furnish a simulator-type model of the entry monitor display for use in the manned centrifuge tests to be conducted at the NASA Johnsville facility. This model is being designed to permit varying the sizes of the display elements and the intensity of the integral lighting to obtain critical human factors data required for developing the flight and simulator models.

The in-flight test system (IFTS) will be of the 225-channel comparator type. A subcontractor has been selected and procurement will proceed pending approval of the subcontractor by NASA.

Service Propulsion Subsystem (SPS)

Titanium forgings for the SPS tank doors were received during the report period. Detail, assembly, and installation drawings were released.

Studies show that the capillary reservoir in the SPS propellant tanks will not retain propellant for engine starting during the lunar excursion module rendezvous. Design changes are being made to resolve this problem.

Three SPS test fixtures were completed. Final checkout of one fixture was completed, and it was shipped to the subcontractor. Checkouts of the remaining two are nearing completion—one will be shipped to WSMR and the other to AEDC.

Eighty-two firings were completed in the SPS engine injector development program during the report period. Evaluation of the modifications to the doublet and quadlet injector patterns is continuing. Table 1 lists all the firings made during the report period.

The first simulated altitude firing of a full-scale SPS engine was conducted at AEDC. The titanium nozzle extension was damaged due to test cell pressure change. Testing will be resumed following the scheduled two-week AEDC maintenance period and relocation of the AEDC steam ejector system to reduce test cell pressure variations. Additional checkout firings will be conducted with the titanium nozzle extensions prior to the initial tests with a columbium unit.

Contracts will be placed for the following SPS components during the next report period: helium tank fill disconnects, system test point disconnects, helium isolation solenoid shutoff valves, fuel and oxidizer

Table 1. Injector Development Test Program
Apollo Service Propulsion Engine

Serial Number	Pattern Designation and Type	Type of Evaluation	Number of Firings	Number of Unstable Firings	Remarks
AFF-1	Doublet	Pattern evaluation	3	3	Numerous face cracks at 1200 to 1300 cps
AFF-2	Quadlet	Pattern evaluation	1	1	Rough
AFF-3	Doublet	Pattern evaluation	2	2	
AF-33	PONX-51-6, Quadlet	Pattern evaluation	23	4	Eighteen stable firings made with MMH; five runs conducted with Aerozine 50
AF-26	PONX-51-9 and 10, Quadlet	Pattern evaluation	2	0	
		Injector/chamber compatibility	4	0	Last firing-200 seconds with no streaking
		C*	4	0	C*=5417-96. 89 percent
AF-19	POUL-31-4, Doublet	C*	4	0	C*=5469-97. 82 percent
		Injector/chamber compatibility	8	2	Compatible during stable operation; rapid erosion during unstable condition
AF-29	POUL-31-5, Doublet	C*	15	8	C*=5468 to 5545 Bleed holes drilled after 10 firings
AEDC Engine No. 2	AF-26, Quadlet	Checkout firing	4	2	
BF-19	Doublet	Baffle durability	10	0	Combustion characteristics similar to AF-26; baffle bleed holes incorporated
BF-15	Long Impingement, Triplet	Baffle durability	2	0	Last firing very rough

C* = Characteristic exhaust velocity

flexible connectors, fuel and oxidizer line, mounted helium heat exchangers, and check valves.

Reaction Control Subsystem (RCS)

The service module RCS propellant quantity gaging system was modified to provide an off-ratio (fuel-to-oxidizer ratio) comparator system in conjunction with the RCS module warning lights.

A review of the system design has shown that the helium tank maximum fill pressure can be reduced from 4500 psi to 4150±50 psi for both command module and service module RCS. Maximum working pressure may be reduced also from 5000 psi to 4500±50 psi.

Tests were conducted on three Phase I ablative thrust chambers, one Phase I copper thrust chamber, and two Phase II ablative thrust chambers. Each of the Phase I ablative thrust chambers tested included macerated ablative material and capsulated Gemini experimental throat inserts. Excessive cracking of the ablative material occurred during operation of each engine, although two of the engines did complete the scheduled tests, which included 60 seconds of acceptance testing and 100 seconds of pulse mode operation. Some minor cracking of both the silicon carbide and tungsten capsulation occurred on the throat inserts following 160 seconds of operation, but no decrease in engine performance was noted.

The Phase I copper thrust chamber was used to evaluate the performance of two injectors that were modified to eliminate excessive pressure drop in the oxidizer flow path. The first modified injector, which had enlarged oxidizer orifices only, showed six percent lower performance than the current injector. The second modified injector had enlarged fuel and oxidizer orifices, and performed as well as the current injector. The second modified injector will be used to determine the effect of this modification on the 45-degree oriented ablative material in the combustion chamber.

Both of the Phase II thrust chambers that were tested incorporated injectors with enlarged oxidizer orifices only. Severe circumferential cracking of the macerated ablative material occurred on both thrust chambers. Both engines exhibited performance that was 6 percent lower than had been obtained with the unmodified injector.

A development program was started to eliminate cracking of the throat insert. Two alternate designs will be tested during the next report period, and the best design will be incorporated in a representative number of the Phase II engines. The two insert designs that have been selected are a graphite design with a siliconized surface and a laminated silicon carbide design with a refractory metal shrink ring.

As a result of the high incidence of macerated ablative material failures that have occurred in the development program, alternate design concepts are being evaluated to eliminate this problem.

Marquardt experienced two thrust chamber failures with their fuel-cooled injector design. Testing showed this injector design produced higher pressure and thrust spikes during the starting period than did the 8-on-8 or 12-on-12 injectors.

Prototype testing is in progress at Marquardt using an engine design with the 12-on-12 injector. Steady-state and pulsing performance for this design have not been established, but tests of one unit have shown it to be equal to or slightly better than the design employing the 8-on-8 injector. Soakback temperatures are expected to be lower than those observed with the 8-on-8 injector.

Launch Escape Subsystem (LES)

Four of eight LES motors were static-fired successfully during the report period. These four motors were tested in environments that included accelerated aging, temperature cycling, temperature gradient, and drop tests. Three of the remaining four development motors were scrapped when they were found to contain cracks in the propellant grain. The cracks were caused by moisture-induced weakening of the propellant surface. This problem has been resolved by the use of a dessicant during manufacture and storage. As a result, completion of development testing will be delayed four weeks.

Nine pitch control motors were tested successfully during the report period. Two other motors failed the test - one failure was due to a burn-through of the pressure-measurement line caused by failure to fill the line with oil, and the other was due to an aft closure blow-off caused by a nozzle with a very small throat. Corrective measures have been taken.

The first tower jettison motor to be ignited with hotwire cartridges was fired after undergoing vibration testing. During the vibration tests, several rivets holding the firing unit pads to the interchange failed. The interchanges on boilerplate 6 and its spare motor have been altered to correct this problem.

The initial series of pellet basket and pyrogen tests were conducted using hotwire initiators. These igniter cartridges proved to be a suitable substitute for the explosive bridgewire initiators.

INTEGRATION

Systems Integration

An integrated operational plan was completed for spacecraft 011 manned orbital mission and will be used for planning the following:

1. Provision of a basis for writing checkout procedures
2. Definition of a sequence for operational checkouts of spacecraft components
3. Verification of requirements for GSE and establishment of system test points

A separate plan for each boilerplate and spacecraft flight mission will be issued.

Test requirements were released for test fixture F-2 and spacecraft 001. This document will provide specific data on the integrated test requirements to evaluate performance, compatibility, and reliability of the active systems on spacecraft 001 at WSMR during hot propulsion system firings. The four test evaluation phases are integrated SCS/partial ECS/ display panel, SPS, RCS, and ECS. The descriptive test requirements are supplemented with detail matrices for additional clarification. This document contains measurement requirements lists and data readout specifications.

S&ID is proceeding with the adapter and separation system study. The adapter panel separation and ejection concepts developed for the Saturn-I adapter are also being considered for application to the Saturn-V adapter. The LES tower separation system explosive bolt concept is being considered for use in the separation of the lunar excursion module from the adapter supports.

The Apollo-to-Little Joe II interface coordination document has been completed except for the electrical interface requirements. The document is being forwarded to NASA-MSC for review.

Apollo Engineering personnel were briefed at McDonnell Aircraft on the Gemini-Agena docking test program. Major points of the briefing covered simulation activities, docking and attenuation configuration and capabilities, docking design criteria, docking dynamics, and quarter-scale dynamic test setup. Future test plans will consider a full-scale docking trainer that will be used for astronaut training.

Ground Support Equipment (GSE)

All GSE for boilerplate 6 has been delivered to WSMR except the substitute units used for prelaunch checkout of the LES, the command module, and the pyrotechnic initiators. The GSE electrical design for boilerplates 12 and 13 was also completed.

Preliminary concepts and technical data for each of the special test unit (STU) models were reviewed with NASA. As a result, Model 600 was divided into two models covering the electrical power subsystem and the fuel cell heater power control; Model 607 was deleted and three new models were identified for local manual control of the oxygen, hydrogen, and helium servicing units; and the layout of Model 608 was revised so that one bay can be used under certain test conditions with Model 614.

The long lead times required in the procurement of cable connectors for the STU will adversely affect STU manufacturing completion dates. Special efforts are being made to correct this delivery problem.

Design was started during the report period on the following GSE models:

1. RCS handling and installation set

2. Propellant tank sling

3. Sling removable skin

4. Workstand for the spacecraft integrated system test

5. Fluid distribution subsystems (environment test at AMR)

6. Fluid distribution subsystem (RCS test at AMR)

7. Hydrogen mass spectrometer leak tester

8. RCS oxidizer servicing unit

Design change of the data distribution and recording unit to incorporate NASA-furnished Esterline-Angus recorders is scheduled for completion during the next report period.

Reliability

Identification and traceability (I&T) requirements for the Apollo program were defined and are being implemented. NASA agreed to the plan submitted by S&ID in which Engineering drawings will specify I&T requirements. Traceability of a part will normally begin with the manufacturing processes. In those cases requiring traceability to a greater degree, the applicable drawings will specify in detail the method to be used. Process and general I&T specifications were issued for internal use; similar documents are being prepared for supplier and subcontractor requirements.

An evaluation of I&T requirements for all parts on boilerplates 6, 12, and 13 was completed. Requirements were established only for the component parts of sequencers, pyrotechnic devices, the complete earth landing system, and for critical forgings.

Design reviews were made of the fuel cell subsystem, the IFTS (preliminary), and the SCS. As a result, studies are being conducted to resolve the following problems:

1. The necessity of having to remove fuel cells 1 and 3 to remove fuel cell 2.

2. The limited accessibility of the H_2 and O_2 fuel cell solenoid shut-off valves.

3. The inadequacy of the present IFTS design for providing all required maintenance data.

4. The elimination of the IFTS cold plate to affect a weight saving of 7 pounds.

5. An improvement in the arrangement of the lower equipment bay to reduce the time required for in-flight maintenance tasks.

6. A weight reduction of the SCS by several proposed methods.

7. An improvement in the reliability of 150 SCS relays.

8. Possible changes to the SCS procurement specification to control the cleanliness of the assembly area.

[redacted]

OPERATIONS

DOWNEY

A preliminary review of the static test tower arrangement to support boilerplate 12 operations was accomplished. The drawings of the layout were completed and submitted for approval during the report period. The GSE support requirements for boilerplate 12 static test tower operation were completed.

Rework of the pulse code modulation decommutator for the telemetry ground station has been completed.

A hardwire concept will be used for the R&D measurements in the design of the instrumentation system for spacecraft 009. Apollo Test and Operations and Engineering personnel presented this instrumentation system design concept to NASA -MSC during the report period.

Detailed floor space requirements and allocations for the environmental proof program were prepared and presented to NASA on 9 July 1963. These requirements were generally acceptable to NASA and will be used for detailed building plans and construction at MSC.

The operational test procedures for boilerplates 12 and 13 are being prepared and will be published within the next report period.

Individual system test requirements and test plans for the environmental proof test will be presented to the NASA for comments prior to incorporation into the General Test Plan.

WHITE SANDS MISSILE RANGE

During the report period, test preparation on boilerplate 6 was completed, and the vehicle was shipped to the WSMR for field test. The shipping schedule was as follows:

[redacted]

Schedule	Date
Command module accepted by NASA	29 June
Command module shipping preparations completed	30 June
Command module transported to Long Beach Airport	1 July
Command module loaded on C-133B and airlifted to Holloman Air Force Base New Mexico	1 July
Command module transported from Holloman Air Force Base to WSMR assembly building	2 July

The command module is at the WSMR hazardous assembly building undergoing receiving inspection.

NASA has agreed to the preparation of test fixture F-2 at the Los Angeles Division of NAA. NAA has confirmed the schedule for manufacturing and checkout. Present scheduling indicates a satisfactory delivery date.

Ninety-five percent facility design review for the propulsion system development facility (PSDF) complex 2 is scheduled for July 1963.

Field operations on boilerplate 6 in preparation for launch of the test mission will be continued during the next report period.

ATLANTIC MISSILE RANGE

An analysis was conducted of the command module air leakage test requirements for boilerplate 13, based upon a new thermodynamics study. As a result of this study, it was determined that leak tests would be performed after manufacturing only.

A list of present GSE requiring facility electrical power to test boilerplate 13 was prepared to indicate the type of receptacle plug needed for each unit. This list was forwarded for interface negotiation with NASA.

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FACILITIES

DOWNEY

Systems Integration and Checkout Facility

All structural steel erection was completed on July 9. The steel roof joists were positioned on July 10 and welded in place on July 11. Approximately 30 percent of the second floor slab has been poured, and the builder is stripping the forms and re-forming for the next pour. The excavation of the depressed area under the service rooms is about 90 percent complete. Installation of the grounding mat started on July 5. The installation of the overhead fire protection sprinkler system is proceeding on schedule.

Construction progress on the facility as of 14 June 1963 is shown in Figure 5 and as of 15 July 1963 in Figure 6.

Building 6 Modification and Data Ground Station

Construction work is proceeding satisfactorily, and demolition work for the first floor phase is essentially completed.

Space Systems Development Facility - Part I

The site and foundation contractor completed casting the structural thermal area piping on July 9. Form work, and installation of structural and reinforcing steel for the structural thermal slab was begun.

Space Systems Development Facility - Part II Reaction Control Facility

Pouring of tilt-up panels and reinforced concrete walls is progressing on schedule.

INDUSTRIAL ENGINEERING

The transfer of manufacturing support at the Slauson facility to the Apollo Program is proceeding with an interim and a final plan of action. The final plan of action, which must await review by NASA of electrical electronic fabrication specifications, involves the possibility of relocating some manufacturing support to the Compton facility.

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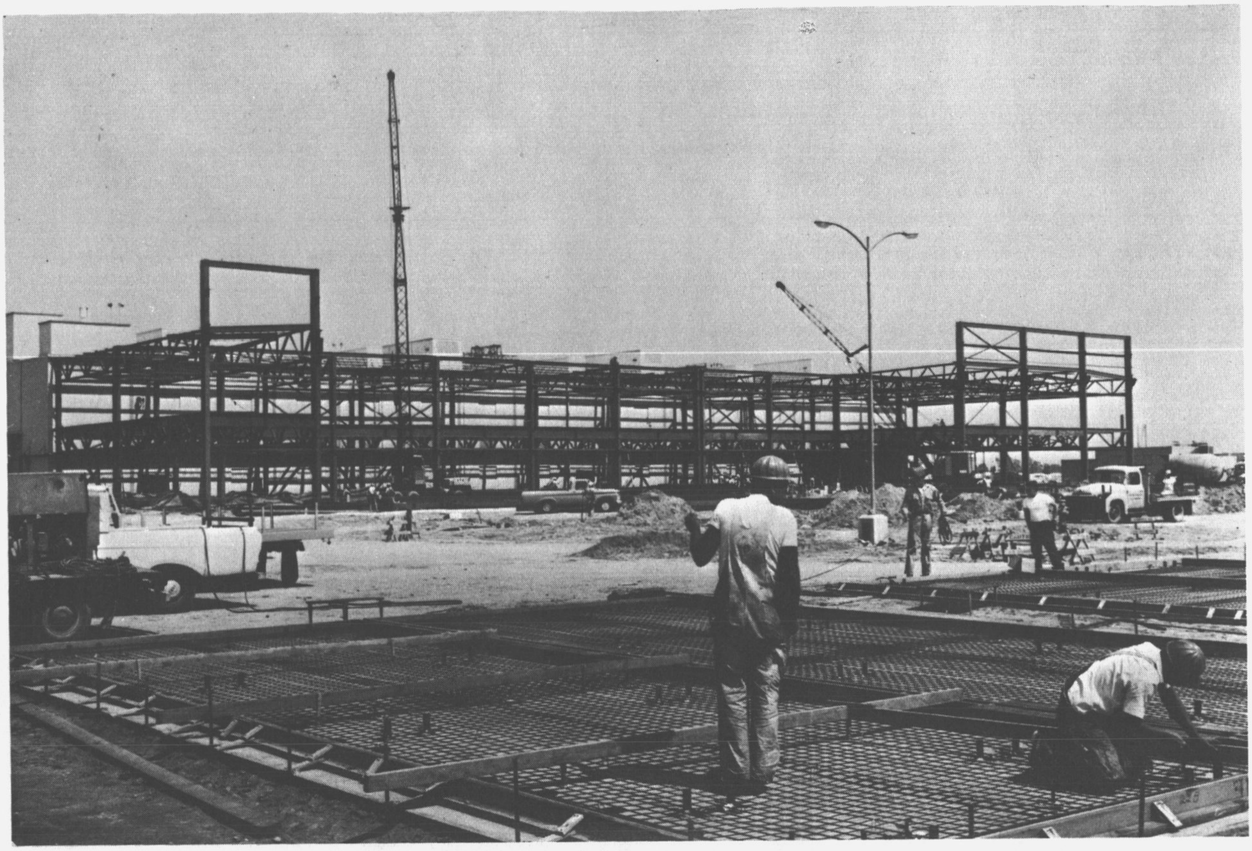

Figure 5. Building 6A, 14 June 1963

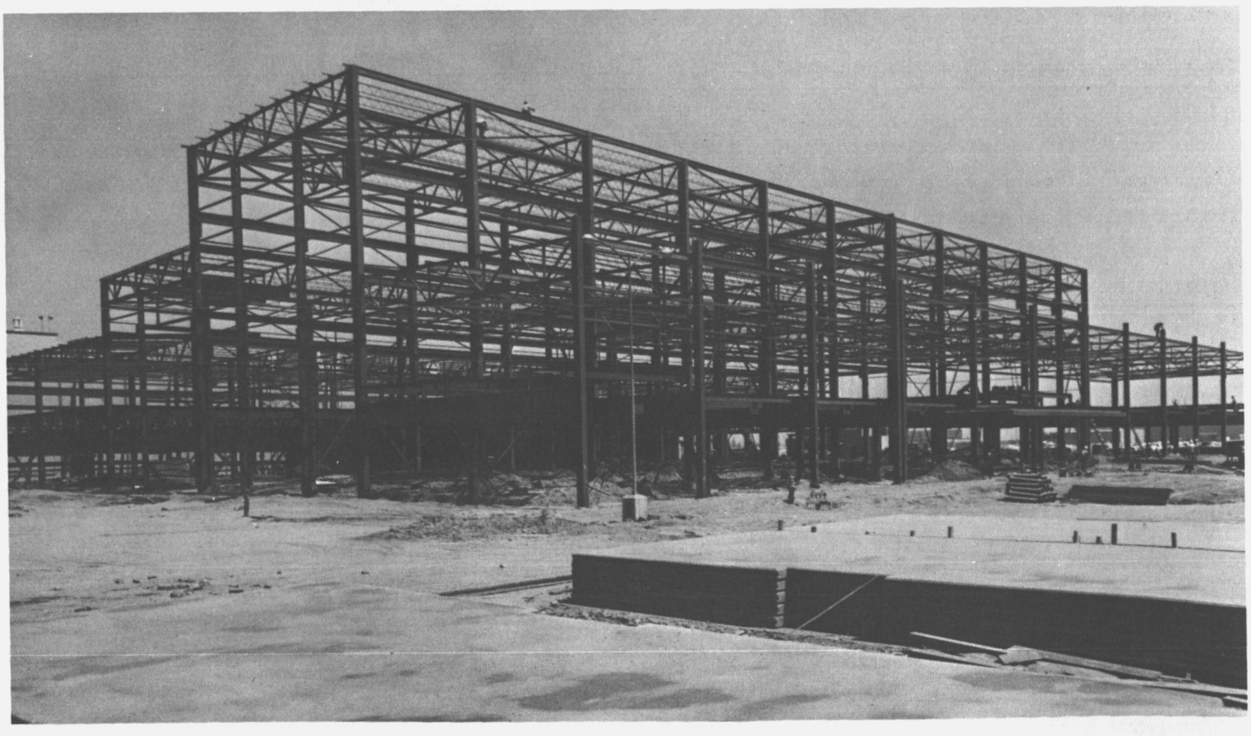

Figure 6. Building 6A, 15 July 1963

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Modification of the first floor of building 6 will be completed early in August. This area will then be occupied by Engineering groups from the second floor and the modification of the second floor will begin.

APPENDIX

S&ID SCHEDULE OF APOLLO MEETING AND TRIPS

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S&ID Schedule of Apollo Meetings and Trips
16 June to 15 July 1963

Subject	Location	Date	S&ID Representatives	Organization
Equipment conference	Newberry Park, California	16 June	Matson, Idleman	S&ID, Northrop-Ventura
LEM adapter meeting	Bethpage, Long Island, New York	16 June	Ellis, Bucuvalas, Brown, Strakosch, Stern, Bardner, Smith, Romanelli, Harms, Stone, Izzi, McWaters, Paulsrud, Hidlerman	S&ID, Grumman
Availability meeting	Washington, D. C.	16-17 June	Sevenson	S&ID, NASA
Fuel cell program review	Hartford, Connecticut	16-17 June	Nelson	S&ID, Pratt & Whitney
Test site and logistics engineering meeting	AMR	16-21 June	Shaughenessy, Parker	S&ID, NASA
Parachute drop tests	El Centro, California	16-21 June	Trebes	S&ID, 6511th Test Group
Gemini spacecraft systems meeting	Houston, Texas	16-21 June	Wilen, Morris	S&ID, NASA
Wind tunnel tests	Buffalo, New York	16-28 June	Biss, Scotoline	S&ID, Cornell Aeronautical Laboratory
Wind tunnel tests	Mountain View, California	16-21 June	Vardoulis, Pagaza, Davey	S&ID, Ames
Test site and support requirements meeting	WSMR	16-21 June	Wascher	S&ID, NASA
Docking simulation study	Columbus, Ohio	16-24 June	Bohlen, Dudek, Scheiman	S&ID, NAA-Columbus
Boilerplate support meeting	WSMR	17 June	Shell, Bunbar	S&ID, NASA
Engineering representative	Houston, Texas	17 June	Wroble	S&ID, NASA
Centrifuge design meeting	Houston, Texas	17-18 June	Hornick, Canby, Staniec, Oliver, Overman, Fordiani, Montgomery	S&ID, NASA
Layout meeting	Boston, Massachusetts	17-18 June	Moreland	S&ID, MIT
Subsystem panel meeting	Houston, Texas	17-19 June	Dwinell, Robinson, Chiavacci, Whitehead, D'Ausilio, Manaker, Dorrell	S&ID, NASA
Configuration control meeting	AMR	17-20 June	Highland, Campbell	S&ID, NASA

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S&ID Schedule of Apollo Meetings and Trips (Cont)
16 June to 15 July 1963

Subject	Location	Date	S&ID Representatives	Organization
LEM discussion	Hampton, Virginia	17-20 June	Gustavson, Meston, McCleary	S&ID, Langley Research Center
Parachute retention and heat shield meeting	El Centro, California	17-21 June	Dowling, Widener, Gibbs, Bean	S&ID, Naval Air Facility
Contract negotiations	Newberry Park, California	17-21 June	Beatty	S&ID, Northrop-Ventura
Mechanization and configuration control meeting	Minneapolis, Minnesota	17-22 June	Watson, Stiles	S&ID, Minneapolis-Honeywell
Phase I testing	Tullahoma, Tennessee	17-24 June	Borde, Cadwell	S&ID, AEDC
PERT meeting	Houston, Texas	18-19 June	Blue, DeRover	S&ID, NASA
S-band design review	Scottsdale, Arizona	18-20 June	Pope, Hall, Frost, Rose	S&ID, Motorola
Resident engineer	Sacramento, California	18-21 June	Borde	S&ID, Aerojet-General
Design review	Minneapolis, Minnesota	18-21 June	Wessling	S&ID, Minneapolis-Honeywell
Management office setup	Sacramento, California	18-21 June	Beck	S&ID, Aerojet-General
Unloading and delivery coordination	WSMR	18-22 June	Ginley	S&ID, NASA
Design review	Tulsa, Oklahoma	18-22 June	Burns, Bakke	S&ID, NAA-Tulsa
Life Systems requirements coordination	Columbus, Ohio	18-22 June	Kulp, Shamis	S&ID, NAA-Columbus
Spares parts and support analysis meeting	Redlands, California	19 June	Beadle	S&ID, Lockheed
Procedures and configuration control meeting	WSMR	19 June	Williamson, Kosovich	S&ID, NASA
Test panel meeting	Houston, Texas	19-20 June	Harvey, Bendees, Williamson, Gustavson, Stungis, Butler	S&ID, NASA
Spares parts and support analysis meeting	Van Nuys, California	19-21 June	Dohl, Hough, Cooper	S&ID, Marquardt
Manual coordination	Cambridge, Massachusetts	19-21 June	Martin	S&ID, MIT

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S&ID Schedule of Apollo Meetings and Trips (Cont)
16 June to 15 July 1963

Subject	Location	Date	S&ID Representatives	Organization
Electrical system integration meeting	Huntsville, Alabama	19-21 June	Crawford, Dushman, Turk	S&ID, NASA
Receiver and beacon discussion	Cedar Rapids, Iowa	19-21 June	Backman	S&ID, Collins
Auxiliary and handling discussion	Tulsa, Oklahoma	19-21 June	Rugh	S&ID, NAA-Tulsa
Tooling coordination	Wilmington, Massachusetts	19-21 June	Smith, Walkover, Lacey	S&ID, Avco
Spares parts and support analysis meeting	Culver City, California	19-21 June	Gaskey, Wicklander	S&ID, Arnoux Corp.
Program presentation and shielding effectiveness meeting	Houston, Texas	19-29 June	Laubach, Raymes	S&ID, NASA
Parts breakdown and supply coordination	Glendale, California	20 June	Miltoko, Madison	S&ID, Aerojet-General
Antenna patterns discussion	Falls Church, Virginia	20 June	Bush	S&ID; Melpar, Inc.
Test program presentation	Houston, Texas	20-21 June	Rousculp, Charnock, Darlington, Fuller	S&ID, NASA
Handling concept presentation	Houston, Texas	20-21 June	Embody, Hillburg	S&ID, NASA
Explosive bolt suppliers coordination	Mesa, Arizona	20-21 June	Murphy	S&ID, Talley Industries
Solar proton-working system meeting	Houston, Texas; Boston, Massachusetts; Ottawa, Canada	20-24 June	Fletcher	S&ID, NASA S&ID, Ewen-Knight Corp. S&ID, National Research Council
Heat shield approval	College Park, Maryland	21 June	Bush	S&ID, Radcom-Emertron
GSE mechanization review	Minneapolis, Minnesota	21-24 June	Cooper, Miller	S&ID, Minneapolis-Honeywell
PERT review	Sacramento, California	21-26 June	Young	S&ID, Aerojet-General
Inventory meeting	WSMR	21-29 June	Rimmer	S&ID, NASA
Design review meeting	Melbourne, Florida	21-27 June	Pope, Moore, Dorrell, Renfore, Rose, Frost, Kronsberg	S&ID; Radiation, Inc.

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S&ID Schedule of Apollo Meetings and Trips (Cont)
16 June to 15 July 1963

Subject	Location	Date	S&ID Representatives	Organization
Cost control meeting	Paramus, New Jersey; Melbourne, Florida; Scottsdale, Arizona	21 June 2 July	Hagelberg, Albinger	S&ID, ACF S&ID; Radiation, Inc. S&ID, Motorola
Program and schedule review	Boulder, Colorado	23-24 June	Nelson	S&ID, Beech
Mechanical interface requirements meeting	Elkton, Maryland	23-25 June	Warme	S&ID, Thiokol
Logistics coordination	WSMR	23-26 June	Miller	S&ID, NASA
Schedule discussion	Buffalo, New York; Indianapolis, Indiana	23-26 June	Williams	S&ID, Bell Aerosystems S&ID, GM-Allison Division
Requirements and spares coordination	Minneapolis, Minnesota	23-28 June	Wallace, Giefer	S&ID, Minneapolis-Honeywell
Logistics data meeting	Boulder, Colorado	23-28 June	Osteaard	S&ID, Beech
Chamber testing data analysis	Sacramento, California	23-28 June	Mower, Ross	S&ID, Aerojet-General
Monthly coordination	Rolling Meadows, Illinois	23 June 2 July	Stady, Alvarez, Forett, Cason	S&ID, Elgin
Prototype inspection	Long Island City, New York	24 June	Wishon	S&ID, Alderson Research Laboratories
Management review	Sacramento, California	24-25 June	Bellamy, Ross, Field, Cadwell	S&ID, Aerojet-General
Requirements and spares coordination	Cedar Rapids, Iowa	24-26 June	Comensky, Kudej, Badostain	S&ID, Collins
Vendor survey	Scottsdale, Arizona	24-26 June	Anderson, Covington	S&ID; Motorola, Inc.
Technical information familiarization	Hartford, Connecticut	24-28 June	Warner, Boerner, Montoya	S&ID, Pratt & Whitney
Fuel cell conference	Hartford, Connecticut	24-28 June	Hulley, Warner, Vallin, Orr, Lee	S&ID; Pratt & Whitney
Process specifications preparation	Houston, Texas	24-28 June	Dacus	S&ID, NASA
Contract negotiations	Newberry Park, California	24-28 June	Beatty	S&ID, Northrop-Ventura
Training coordination	Houston, Texas	24-28 June	McNeese, Bennett	S&ID, NASA

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S&ID Schedule of Apollo Meetings and Trips (Cont)
16 June to 15 July 1963

Subject	Location	Date	S&ID Representatives	Organization
Boilerplate wiring meeting	Minneapolis, Minnesota	25 June	Elleri	S&ID, Minneapolis-Honeywell
Support analysis	Los Angeles, California	25-26 June	Mitchell, Weglin, Otterstein	S&ID, AiResearch
Preparations review	WSMR	25-26 June	Paup, Pearce	S&ID, NASA
Flight technology systems meeting	Houston, Texas	25-26 June	Gershun, Cook, Schurr, Koppang	S&ID, NASA
Navigation and guidance meeting	Houston, Texas	25-27 June	Louie, Andrews, Ontiveros	S&ID, NASA
Stabilization and control system discussion	Minneapolis, Minnesota	25-27 June	Dyson	S&ID, Minneapolis-Honeywell
Accessibility review	AMR	25-27 June	Gardner, Sweeney, Carney	S&ID, NASA
Space position investigation	El Centro, California	25-27 June	Young, Stearns	S&ID, Naval Air Facility
Test site relocation	WSMR	25-27 June	Cameron, Coulson	S&ID, NASA
Special tooling coordination	Elkton, Maryland	25-28 June	Hobson	S&ID, Thiokol
Change negotiations	Middletown, Ohio	25-29 June	Stover, Peterson, Sheppard, Smith, Kerr, Weller	S&ID, Aeronca
Engineering coordination	AMR	25-29 June	Kroffe, Corpening	S&ID, NASA
Gemini discussions	Johnsville, Pennsylvania	25-30 June	Hornick, Oliver	S&ID, NADC, AMAL Center
Logistics meeting	Pasadena, California	26 June	Dortch	S&ID; A-F Sales & Engineering, Inc.
Maintenance data coordination	Canoga Park, California	26 June	Cooper, Dohl	S&ID, NAA-Rocketdyne
Signature coordination	San Diego, California	26 June	Ridlon	S&ID, GD-Convair
GSE meeting	Tulsa, Oklahoma	26-27 June	Bailey, Lindley, Truman	S&ID, NAA-Tulsa
Interface meeting	Houston, Texas	26-27 June	Coulson, Overton, Ryker	S&ID, NASA
Contract discussions	WSMR	26-27 June	Coulson	S&ID, NASA
Flight technology meeting	Houston, Texas	26-27 June	Goldman	S&ID, NASA

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S&ID Schedule of Apollo Meetings and Trips (Cont)
16 June to 15 July 1963

Subject	Location	Date	S&ID Representatives	Organization
Stabilization and control meeting	Houston, Texas	26-27 June	Antletz, Jansz, Johnson, Paxton, Watson	S&ID, NASA
Coordination meeting	Princeton, New Jersey	26-28 June	Stady, Forrette	S&ID, RCA
Fact finding meeting	Metuchen, New Jersey	26-28 June	Musso, Olson, Schwarzmann, Graham, Stoffel, Vausbinder, Guimont Stady	S&ID, Applied Electronics
Pretest conference	Hampton, Virginia	26-28 June	Gillies	S&ID, Langley Research Center
Contract and pricing meeting	Houston, Texas	26 July 1 July	Sack	S&ID, NASA
Test facilities familiarization	El Centro, California	26 June 1 July	Norbut	S&ID, Naval Air Facility
Service module manual meeting	WSMR	27 June	Kennedy, Hickerson, Phillips, Cloyd, Schipman, Smothers, Calvert	S&ID, NASA
Cost negotiations	Newberry Park, California	27-28 June	Byrd	S&ID, Northrop-Ventura
OTP coordination	WSMR	27-28 June	Proctor, Butler	S&ID, NASA
Contract cost data meeting	Minneapolis, Minnesota	27 June 3 July	Rothacher, Sheppard	S&ID, Minneapolis-Honeywell
Weight and balance meeting	WSMR	28 June	Hedger, Sheeley	S&ID, NASA
Technical interface coordination	Cambridge, Massachusetts	28 June	Lew, O'Brien	S&ID, MIT
Human impacts tests	Dayton, Ohio	30 June	Shelton	S&ID, WPAFB
Tank design program coordination	Buffalo, New York	30 June	Johnson	S&ID, Bell Aerosystems
Structural details resolution	Windsor Locks, Connecticut	30 June 1 July	Jobson, Brundin	S&ID, Hamilton Standard, United Aircraft Corp.
High gain antenna system review	Woodside, Long Island, New York	30 June	Buyer, Farrell, McCabe, Womack	S&ID; Avien, Inc.
Instrumentation concept meeting	Houston, Texas	2 July	Aber, Altenbernd, Garing, McCuen	S&ID, NASA
GSE installation meeting	WSMR	2-3 July	GeBhart, Jolley	S&ID, NASA

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S&ID Schedule of Apollo Meetings and Trips (Cont)
16 June to 15 July 1963

Subject	Location	Date	S&ID Representatives	Organization
Parachute drop tests	El Centro, California	5 July	Young	S&ID, 6511 Test Group
Chamber compatibility discussion	Sacramento, California	5 July	Mower	S&ID, Aerojet-General
Test site coordination	St. Louis, Missouri	5 July	Carroll, Kuntz	S&ID, McDonnell
GSE meeting	Tulsa, Oklahoma	5 July	Lindley, Dunn, Donaldson, Knoll	S&ID, NAA-Tulsa
Design review	Metuchen, New Jersey	5-10 July	Bradanini, Beisner	S&ID, Applied Electronics
Qualification test plan and procedures meeting	Minneapolis, Minnesota	5-18 July	Watson, Johnston, Carpenter, Radeke	S&ID, Minneapolis-Honeywell
Parachute installation	WSMR	5-19 July	Byrd	S&ID, NASA
Weight and balance meeting	WSMR	6-28 July	Beets	S&ID, NASA
Invoice authorization	Long Island City, Long Island	7 July	Hawken, Vausbinder	S&ID, Alderson Research Laboratories
Umbilical separation test	San Diego, California	7 July	Greenberg	S&ID, GD-Convair
Technical interchange meeting	Downey, California	8 July	Matthews	S&ID, NASA
Site support requirements discussion	WSMR	8 July	Maleck	S&ID, NASA
Tank test review	Indianapolis, Indiana	8 July	Dapaquier	S&ID, GM-Allison Division
Integration review meeting	Houston, Texas	8 July	Sparrs, Hayes, Smith, Ryker, Sheeren, Henderson, Griffith-Jones, Blue, Welsh	S&ID, NASA
Boilerplate coordination	WSMR	8 July	Tropila	S&ID, NASA
Injector development tests and design review	Sacramento, California	8 July	Borde, Ross, Field, Cadwell	S&ID, Aerojet-General
Detection system meeting	Huntsville, Alabama	8-9 July	Tutt	S&ID, NASA
Airframe discussion	Houston, Texas	8-10 July	Langmore, Shanahan, Webster, Kalayjain, Field	S&ID, NASA

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S&ID Schedule of Apollo Meetings and Trips (Cont)
16 June to 15 July 1963

Subject	Location	Date	S&ID Representatives	Organization
Contract negotiations	Newberry Park, California	8-15 July	Beatty, Canon, Cagni	S&ID, Northrop-Ventura
Wind tunnel tests	Tullahoma, Tennessee	8-15 July	Emerson	S&ID, AEDC
Facilities review	Houston, Texas	9 July	Altenbernd, Keyes	S&ID, NASA
Backup data completion	Downey, California	9 July	VanValenburg	S&ID, NASA
Phase I review	Tullahoma, Tennessee	9-10 July	Cadwell	S&ID, AEDC
Specification drawings coordination	Boulder, Colorado	9-12 July	Carnevale	S&ID, Beech
Instrumentation test	Sunnyvale, California	9-12 July	Schilling	S&ID, Radiation Development Laboratories
Cost control meeting	Downey, California	9-12 July	Bowes	S&ID, Collins
Monthly coordination	Houston, Texas	10-11 July	Nelson, Haglund, Ross, Nash, Haky, Thomas	S&ID, NASA
Range safety presentation	AMR	10-11 July	Rooten, Holloway	S&ID, NASA
Manufacturing progress	Buffalo, New York	10-12 July	Peery, Hobson	S&ID, Bell Aerosystems
Hardware status review	Minneapolis, Minnesota	10-13 July	Webster, Langmore	S&ID, Minneapolis-Honeywell
End item documentation requirements discussion	Elkton, Maryland	10-14 July	Sharpe, Yee	S&ID, Thiokol
Instrumentation coordination	WSMR	11-12 July	Jones, Barmore	S&ID, NASA
Equipment pickup	WSMR	11-12 July	Hedger	S&ID, NASA
Electrical wiring checkout	WSMR	11-15 July	Lindsay	S&ID, NASA
SPS engine decontamination	Sacramento, California	12-13 July	Lewis, Bauserman	S&ID, Aerojet-General
Prequalification testing	Tullahoma, Tennessee	13 July	Sheffer	S&ID, AEDC
Letter contract negotiations	Buffalo, New York	14 July	Myers, Hobson, White, Burge, Bevington	S&ID, Bell Aerosystems

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S&ID Schedule of Apollo Meetings and Trips (Cont)
16 June to 15 July 1963

Subject	Location	Date	S&ID Representative	Organization
Test stand installation	Sacramento, California	14-16 July	Thurman	S&ID, Aerojet-General
Flight data personnel meeting	WSMR	14-16 July	Parsons	S&ID, NASA
Simulation meeting	Oak Ridge, Tennessee	14-17 July	Okumura	S&ID, Oak Ridge National Laboratory
Solid propulsion meeting	Seattle, Washington	14-17 July	Golstein, Warme	Symposium
GSE support	WSMR	14 July 10 August	Frank	S&ID, NASA
Communications and equipment training	Cedar Rapids, Iowa	14 July	Johnson, Lenn	S&ID, Collins
GOSS meeting	Houston, Texas	15-16 July	Kiehlo	S&ID, NASA
Propulsion meeting	Houston, Texas	15-16 July	Gibb, Johnson, Eldridge, Relyea, Svenson, Babcock	S&ID, NASA
Simulation program plan	Houston, Texas	15-16 July	Barnett	S&ID, NASA
Crew systems meeting	Houston, Texas	15-19 July	DeWitt	S&ID, NASA
Coordination meeting	Sacramento, California	15-19 July	Ross	S&ID, Aerojet-General
Boilerplate checkout	WSMR	15-19 July	Proctor, Janus, Edson, Gill, Moody, Payne, Karl	S&ID, NASA
Engineering liasion	WSMR	15-19 July	Teter	S&ID, NASA
Wind tunnel tests	Hampton, Virginia	15 July 12 August	Gillies	S&ID, Langley Research Center

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